# Beyond Hierarchy: Towards a Service Model supporting new Sourcing Strategies for IT Services

Matthias K. Hamm, Patricia Marcu, Mark Yampolskiy

Munich Network Management Team,
Leibniz Supercomputing Centre (LRZ),
Boltzmannstr.1, 85748 Garching, Germany
{hamm, marcu, yampolskiy}@lrz.de

**Abstract.** Beyond the classic hierarchical customer/provider relationship, service providers are more and more cooperating with each other on an equal footing. Service modeling techniques have been applied successfully to hierarchical sourcing strategies as a blueprint for service management processes and to define the basis for describing the communication and collaboration between IT service providers. In this paper, we analyze the additional requirements to service modeling arising from alternative sourcing strategies and propose an extension to the MNM (Munich Network Management) service model. An application to a service in use shows how the new concepts incorporated in the service model can be used to properly describe complex provider collaboration scenarios.

## 1 Motivation and Problem Statement

The growing complexity of IT services poses new challenges to *IT Service Management (ITSM)*, not only from the technical perspective, as new services and technologies emerge, but also from an organizational viewpoint. IT service providers are under pressure to meet the growing demand from customers to deliver services with a high quality in a cost-effective manner, regardless how the services are implemented. The issue of end-to-end service quality challenges service providers, as most services are no longer realized stand-alone by a single provider but composed of multiple building blocks supplied by several providers.

In the past, the relationships between service providers in most cases took the form of a hierarchy, where a service provider offers services to a customer and relies on a set of underpinning services delivered by sub-providers to realize these services. In their current releases, both the *IT Infrastructure Library (ITIL)* and the *Enhanced Telecom Operations Map (eTOM)* stress that due to new sourcing strategies, market trends like e-business or regulatory policies new necessities and also opportunities for collaboration between service providers arise [1,2]. Beyond the hierarchical model, alternative forms of provider co-operation gain importance, where multiple providers aim to co-provide services jointly and have to coordinate their activities on an equal footing.

A key issue for realizing service strategies in real-life scenarios is the proper *modeling of services*: According to ITIL, service models are blueprints for service management processes and the basis for communication and collaboration. A service model has the purpose of modeling specific services and giving service service provisioning scenarios in order to analyze needs and demands regarding an appropriate service management [**?**]. However, the existing service models are currently limited to a hierarchical model of provider co-operation. A comprehensive service model supporting provider co-operations is generally lacking.

In this paper, we propose to extend an enhanced service model which also supports services co-provisioned by multiple providers in order to meet the additional requirements of new sourcing strategies. In the next section, the existing approaches in service modeling are described. The new challenges for service modeling are shown in section 3. In section 4, we present our enhanced service model. As a proof of concept, section 5 demonstrates the application of our solution to a complex scenario, the *End-to-End (E2E) link* service of the European scientific network Géant2 [3]. Section 6 concludes this paper with a summary and an outlook to our next steps.

## 2 State-of-the-Art in service modeling

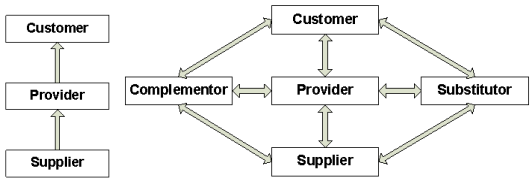
Basic approaches for service modeling were presented in [4]. However, these early works concentrate on organizational issues like the roles involved in service management while technical aspects are not covered properly. In *New Generation Operations Systems and Software (NGOSS)*, service models are used to identify service components and enable service providers to separate service offerings into elementary building blocks [5]. For both ITIL and NGOSS service models are the basis to define *Service Level Agreements (SLAs)*. Unfortunately, neither ITIL or NGOSS give detailed advice on how to construct a service model.

The service model of the *Munich Network Management Team (MNM)* is a detailed approach which has already profen to be useful in the application to complex services and is also compliant to the ITSM frameworks. However, the MNM model assumes a provider hierarchy [6].

## 3 New challenges for provider co-operation

ITIL version 3 proposes a shift from the long-used hierarchical model – identified as a value chain (fig. 1a) – to a view of service management as pattern of collaborative exchanges, called a value network (fig. 1b). In this model, providers can still act as suppliers in the sense of a vertical value chain, but they can also *complement* each other, i.e. deliver different parts of services to common customers. It is also possible that competitors (called *substitutors*) have to co-operate. eTOM uses the term *e-business* to refer to the interaction between business partners. The conceptual model for e-business is quite similar to ITIL's model of service structures.

eTOM and ITIL describe several models of provider collaboration: In eTOM, the value network has to be managed like a self-contained enterprise. A single provider should act as a focal partner of the value network which also interfaces with the customer. ITIL defines a couple of sourcing strategies beneath classical full service outsourcing. With *prime sourcing*, a customer contracts a single provider, but stipulates that the capabilities of other providers are leveraged, e.g. to improve risks. *Consortium sourcing* implies that a customer selects a collection of service providers which are required to collaborate and present a unified interface to the customer. If the customer instead acts as a service integrator itself, i.e. combines the subservices delivered by multiple providers, the *selective outsourcing* model is applied (also known as multi- or co-sourcing). In [7] ITIL's concept of *Operation Level Agreements* (OLA) is broadened to an multilateral agreement between multiple providers in order to facilitate governance of multi-sourcing scenarios.




(a) Value chain (b) Value network

Fig. 1: ITIL service structures [1]

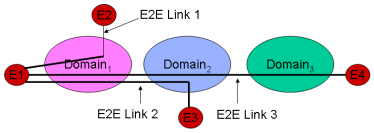



Fig. 2: Géant2 E2E link service

An example for the consortium sourcing model is the E2E link service of the European research and education network Géant2 (see Fig. 2). E2E links are dedicated multi-gigabit optical connections between research centers in Europe and beyond. They are provided by more than 30 National Research and Education Networks (NRENs) each operating its own network [8].

The communality of the new service sourcing strategies is that they introduce additional relationships between customers and providers and also between services. In the hierarchical model, a customer commissions a single provider to deliver a service. This provider then acts as a service integrator in composing subservices together with its own resources to deliver the service. Prime, consortium and also selective outsourcing deviate from this model in the regard that the service integration is different - either the customer does the service integration, or the provider have to co-operate to integrate their services. In order to model such scenarios connected to consortium sourcing and multi-provisioning models, in addition to the requirements as stated in [9] also the following two additional requirements have to be met: First, the service model has to support the case that a *customer commissions multiple providers* with delivering a single service. Second, the model needs capabilities to *model alternative forms of service integration*. To meet these requirements, an extension of the MNM service model is needed.

## 4 Proposal: Extension of the MNM service model

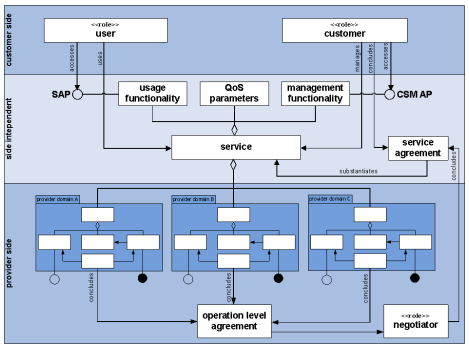



Fig. 3: Extension of the MNM service model

Fig. 3 shows an extension to the MNM service model in order to also meet the additional requirements. The provider side is divided into several provider domains. *Service parts* represent the components at the different provider domains in a collaborative environment. They consist of *service part implementation*, *service part QoS parameters* and *service part management*. Non-hierarchical service integration is modeled using service part interfaces instead. Direct connection of service parts is possible via *service part connection points*. In order to be able to coordinate and manage the multiple service parts as a single service, each service has a *service management access point*.

A service is composed of interconnected service parts. This composition is semantically very rich and covers *all* aspects. To clarify how the service integration is realized exactly, it is recommended to refine this relationship in applications of the model. The connection of the service parts and the realization of federated service management across the service parts is – beside other issues – agreed upon between the provider in an OLA. As the provider side is divided into several provider domains, with the *negotiator* as an additional role is introduced for concluding service agreements between the customer and the multiple providers.

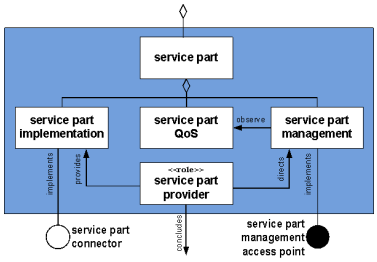



Fig. 4: Detailed service part view

The service model has to be quite flexible to support the various sourcing strategies. Our extension of the MNM model allows the following adjustments: First, the new elements of the service model are optional – if, for example, no OLA between the providers exists, then it can be omitted. Second, additional roles can be added for scenario-specific solutions, e.g. a central coordinator for the management of the service parts. Third, additional relationships between diagram elements can be added, e.g. a link between a SAP and one ore more service part connectors in the case that the service part connectors act as SAP. The model of course still has to support the hierarchical model. All model elements originally introduced in the MNM model which are not shown here are still valid and can be used to model provider hierarchies. Thus, complex scenarios can be modeled as a combination of the MNM model and the extensions shown here.

## 5 Case Study: Modeling of the Géant2 E2E Link Service

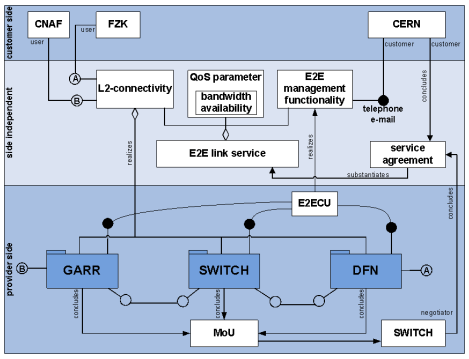



Fig. 5: Géant2 E2E link service - Overview

As an example for the application of the extended service model, fig. 5 shows the service model of the E2E link from the Italian National Center for Research and Development in Bologna (CNAF) to the Research Center in Karlsruhe (FZK). The customer for this link is CERN, the CNAF and FZK organizations act as users of the link. The usage functionality of the link is network connectivity on network layer 2. A service agreement is closed between SWITCH (NREN of Switzerland), acting as a negotiator, and CERN. The usage functionality is in this case realized by a composition of three service parts, representing the link segments provided by GARR (Italian NREN), SWITCH and DFN (German NREN). Each service part has two service part connectors, one at each physical end of the link segment. The users can access the usage functionality directly via the service part connectors *A* or GARR and *B* of SWITCH, which also act as service access points. For the service management, a central E2E coordination unit (E2ECU) interacts with the service part management access points. The collaboration between the providers is guided by a multilateral Memorandum of Understanding (MoU).

The composition relationship between the service and the service parts in fig. 5 has been divided up to show the service integration in more detail: The composition of the service functionality as a chain of service parts is explicitly depicted as well as the realization of a coordinated service management.

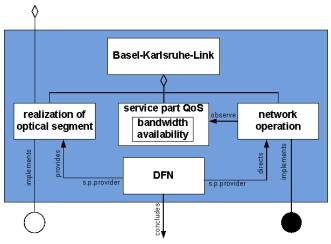



Fig. 6: DFN service part

Fig. 6 shows a detailed view of the DFN service part, that is the link segment between Basel and Karlsruhe. The DFN network operating team acts as service part management that observes the QoS parameters for the service part. The usage functionality of this segment is realized with DFN optical networking resources. At this point, the model could be extended to also include the hierarchical service relationships showing the underpinning networking subservices provided by local providers commissioned by DFN.

This application of the extended service model demonstrates its applicability to a scenario which matches the consortium sourcing model. In general, the service model is suited to model services based on alternative sourcing strategies.

## 6 Current Status and Next Steps

In this paper, we have analyzed the additional requirements to service modeling arising from new sourcing strategies. We introduced the concept of service parts as a means for modeling horizontal service dependencies beyond the classical hierarchical model. We then presented an extension to the MNM service model and demonstrated the applicability of the model using a complex real-life scenario (Geant2 E2E links). Next steps in this work will aim towards a refinement of the model, e.g. to develop guidelines for relationship cardinalities and to clarify the intersection of hierarchical and horizontal service dependencies in full detail. Further assessments will be undertaken using some other scenarios. The refined service model then will be a useful tool in our main research areas, the service management processes for new sourcing strategies.

*Acknowledgment* The authors wish to thank the members of the Munich Network Management (MNM) Team for helpful discussions and valuable comments on previous versions of this paper. The MNM-Team, directed by Prof. Dr. Heinz-Gerd Hegering, is a group of researchers of the University of Munich, the Munich University of Technology, the University of the Federal Armed Forces Munich, and the Leibniz Supercomputing Centre of the Bavarian Academy of Sciences and Humanities. The team's web-server is located at http://www.mnm-team.org/.

## References

1. Group, Object Management: *ITIL Service Strategy*. TSO, London, 2007.
2. Forum, Tele Management: *Enhanced Telecom Operations Map (eTOM). The Business Process Framework. Addendum B.* GB921B, 2007.
3. Geant2: *Homepage*, 2007. [Online: `http://www.geant2.net/`].
4. Kugler, H.-J., A. Mullery N. Niebert (): *Towards a Pan-European Telecommunication Service Infrastructure - ISN '94*, 851. Springer, Berlin u.a., 1994.
5. Forum, Tele Management: *SLA Management Handbook. Volume 2. Concepts and Principles. Rel. 2.5.* GB917-2, 2005.
6. Garschhammer, M., R. Hauck, H.-G. Hegering, B. Kempter, I. Radisic, H. Rölle H. Schmidt: *A Case-Driven Methodology for Applying the MNM Service Model*, 2002.
7. Bhattacharyya, N. Bh. Atri: *Multi-sourcing Governance through Operational Level Agreements*, 2006. [Online: `http://globalsourcing.infosys.com/white-papers/OLA-Paper.pdf`].
8. Yampolskiy, M. M. Hamm: *Management of Multidomain End-to-End Links. A Federated Approach for the Pan-European Research Network Géant 2. Moving from Bits to Business Value: Proceedings of the 2007 Integrated Management Symposium (to appear)*. IFIP/IEEE, München, Germany, May 2007.
9. Garschhammer, M., R. Hauck, H.-G. Hegering, B. Kempter, I. Radisic, H. Rölle, H. Schmidt, M. Langer M. Nerb: *Towards generic Service Management Concepts. A Service Model Based Approach*, 2001.

## Biography

**Matthias Hamm** received a diploma degree (M. Sc.) in Computer Science from the University of Munich (LMU), Germany. As a member of the German Research Network (DFN), he is involved in the Géant2 project since February, 2006. Before that he was engaged in the IT-industry for several years.

**Patricia Marcu** received a diploma degree (M. Sc.) in Computer Science from the University of Munich (LMU), Germany. As a member of the German Research Network (DFN), she is involved in the Géant2 project since September, 2007.

**Mark Yampolskiy** received a diploma degree (M.Sc.) in Computer Science from the Technical University of Munich (TUM). As a member of German Research and Education Network DFN, he is involved in Géant2 project since January, 2006. Before that he worked in IT industry in Russia and Germany with different scopes of development