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An Inter-Organizational Configuration Management Database as Key Enabler for Future IT Service Management Processes

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Abstract: Outsourcing is the remedy for many enterprises to improve their efficiency. However, to be able to assess the potential of one's own as well as the external providers' services, detailed information about the IT infrastructure and services is needed. In currently predominant IT Service Management Frameworks the so-called Configuration Management process provides an information nexus that is implemented by a database referred to as Configuration Management Database (CMDB). For outsourcing and collaboration scenarios such a CMDB should also provide an information basis for inter-organizational usage. Based on this motivation we first present the concept of an inter-organizational CMDB (ioCMDB). However, several IT Service Management disciplines need to be reconsidered in order to take full advantage of the ioCMDB. Thus, this article also presents the related challenges and the key issues for inter-organizational ITSM process enhancement.

1. Introduction

With technological advances, Information and Communication Technology (ICT) infrastructures become even more complex, while at the same time the demand to operate them cost-efficiently rises. Small and medium, but also an increasing number of large enterprises deem outsourcing or co-sourcing as an appropriate solution to improve the efficiency and maximize their benefits.

But to be able to assess and reassess the potential of their own as well as the external providers' services, detailed information about the IT infrastructure and services in sense of management ratios, such as key performance indicators, is needed. Best practice frameworks for IT Service Management (ITSM), such as the Information Technology Infrastructure Library version 3 (ITILv3) [1][2], and standards, such as ISO-IEC 20000-1 [3], provide guidance for management processes that have proven to work and be efficient.

However, for inter-organizational respectively federated services new requirements emerge, which are not entirely covered by the above mentioned frameworks yet. Basically full control over the services which are in use is assumed traditionally. In inter-organizational service applications this point-to-point nature cannot be taken for granted anymore [4]. Furthermore, there are no standardized mechanisms in place to selectively share management information between various service providers [5]. In the course of adopting ITIL, organizations traditionally adopted merely »the processes« of ITIL. But for inter-organizational services it is necessary that also the IT management »tools« adopt ITIL perspectives [6].

One of the most important ITSM processes is Configuration Management (CM). It provides information about the ICT infrastructure to be able to support all management

disciplines like for example Incident Management, Financial Management, and Service Level Management. CM heavily relies on tool support, using the so-called Configuration Management Database (CMDB) as its information nexus, which stores the state of and relationships between Service Assets respectively Configuration Items (CIs). CIs include hardware, software, network components, incident records, policies, and various other information.

We have introduced the concept of an inter-organizational CMDB federation (ioCMDBf), based on the evolving CMDBf standard [7], and discussed its technical architecture concerning access control in previous work [8]. This paper presents the challenges of and proposed solution for inter-organizational ITSM (ioITSM) processes that make efficient use of the ioCMDBf tool support; it can best be described as an extension to well-established best practice frameworks, such as ITILv3.

This paper is structured as follows: In section 2 we describe several real world scenarios, which have in common that the related business services are supplied by the cooperation of multiple organizations. Thus ITSM processes need to cross organizational boundaries. All these cases are lacking from an appropriate tool to support their ioITSM processes. In section 3 we analyze and discuss the resulting disadvantages. Our concept of an ioCMDBf is presented in section 4 as well as the resulting redesign of existing processes by the examples of CM and Incident Management. The benefits of our introduced ioCMDBf are outlined in section 5, and section 6 concludes this article.

2. Our Inter-organizational Services Scenarios

Our research is motivated by the practical demand for inter-organizational ITSM (ioITSM) in the following real-world business scenarios, which intersect at the Leibniz Supercomputing Centre (LRZ) as a central IT service provider:

- Scenario 1: As part of the projects IntegraTUM and elecTUM, which are funded by the German Research Foundation (DFG) and the German Federal Ministry of Education and Research (BMBF), multiple IT services for higher education institutions that formerly have been operated locally are being recentralized at the LRZ. The business service is the students' lifecycle with automated access to IT infrastructure like learning management systems or computer labs [9].
- Scenario 2: The European GÉANT2 project, which is co-funded by the European Commission and Europe's national research and education networks (NRENs), is ensuring high-quality service from one end user to another over multiple interconnected networks (so-called end2end links). End users within GÉANT2 are using such end2end links for transferring data across Europe from one of the endpoints of the 30 participating NRENs to another endpoint within this network [10].
- Scenario 3: The LRZ is participating in Europe's high performance computing (HPC) infrastructure DEISA, which is partially funded by the European Commission. Its high performance computers are used by researchers from all over Europe as well as Grid partners from other continents [11]. The end users here are performing calculations within a Grid or virtualized HPC infrastructure without requiring direct access to the physical machines.

For each of these projects, the LRZ has to support the project specific ITSM process implementations. All of these projects have the following characteristics in common:

- The final business service, as it is perceived by the end user, is accomplished not by a single organization but by multiple organizations.
- For managing the IT services the ITSM has to cross local management domains. However, local management itself is not sufficient for the management of inter-organizational services, thus an inter-organizational ITSM needs to be established.

- There is no appropriate tool support for the respective ITSM processes in place.

The problems resulting from the lack of tool support as they are mitigated by our concept of an ioCMDBf will be described in the next section.

3. Problem Statement and Key Motivation for ioITSM Processes

Inter-organizational services as described in the scenarios above suffer from several drawbacks because an appropriate tool support is missing as of today. By means of the processes of Service Portfolio Management (SPoM), Incident Management, and Financial Management we are demonstrating these challenges in the following.

Within SPoM the service portfolio needs to be managed to improve business value. Without the assistance of an ioCMDBf, it is nearly impossible to quickly gain an overview of which services are offered by whom. This in turn diminishes the capabilities of inter-organizational SPoM, e.g. in order to come to make-or-buy decisions on a profound rationale, such as when almost identical services are offered independently by multiple organizational units. In scenario 1 various IT services are provided by TUM's different organizational units, such as the university's faculties, central administration, and the LRZ as IT service provider (cp. Figure 1). Although the recentralization of email services to the LRZ is already planned within the project IntegraTUM, possible further potential for consolidation might be missed, since there is no information base in place which offers an detailed overview of existing services and their suppliers.

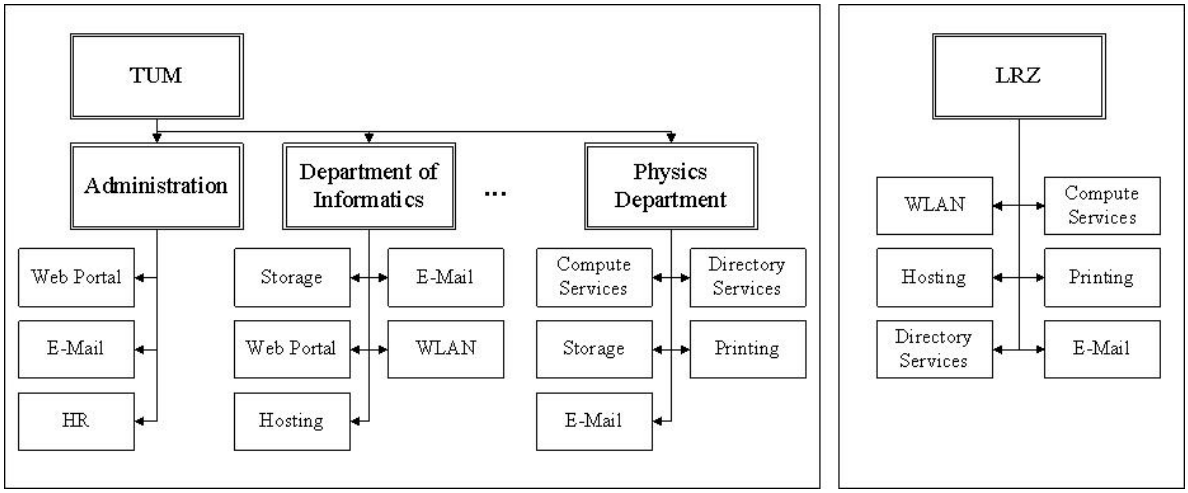

Figure 1: Extract of IT Services Provided by TUM's Organizational Units and the LRZ

Incident Management's goal is to solve interruptions or degradation in service quality as quickly as possible. Without the assistance of an ioCMDBf this process might be rather inefficient, for example if an end-user does not know whom to contact for help during a service incident. The same applies to the service desk agents, e.g. in the case of an email service failure, in order to figure out which of the email servers shown in Figure 1 is the actual root cause.

One of the Financial Management's primary tasks is service accounting. When services are offered by multiple organizations, currently no widely accepted approach is available to support accounting models, such as proposed in [12]. By means of an ioCMDBf, the current state of and the correlation between virtual services, virtual organizations, and real organizations, on which all current Grid models are based, can be derived by a workflow that can be automated to a large degree, which is at present not possible, because there is no ioCMDBf in place yet.

These examples show that on the one hand an appropriate information base like a ioCMDBf is necessary to improve ITSM efficiency like the SPoM's decision processes, the

incident resolution times, and laying out a base for automation of accounting mechanism. On the other hand however, the formerly locally operated ITSM processes need to be adapted respectively enhanced for the interactions with the ioCMDBf.

4. Our Approach for Inter-organizational IT Service Management

Here we describe our concept of an ioCMDBf in section 4.1 and the resulting process enhancements necessary by the introduction of an ioCMDBf in section 4.2.

4.1 Tool Support for Inter-Organizational IT Service Management

Traditionally a CMDBf is used as a logically central information database for the ITSM processes, as depicted for organizations A and B in figure 2. However, for inter-organizationally provided services, the ioCMDBf's logical position shifts to a new ioITSM process layer above the traditional local ITSM layer. This is also the layer that requires the redefinition of ITSM processes, which in turn are adapted to inter-organizational requirements. Therefore, additional roles are required, such as an inter-organizational Change Advisory Board (CAB), and new activities need to be defined, such as the inter-organizational impact analysis based on the properties of CI attributes and relationships across organizational borders.

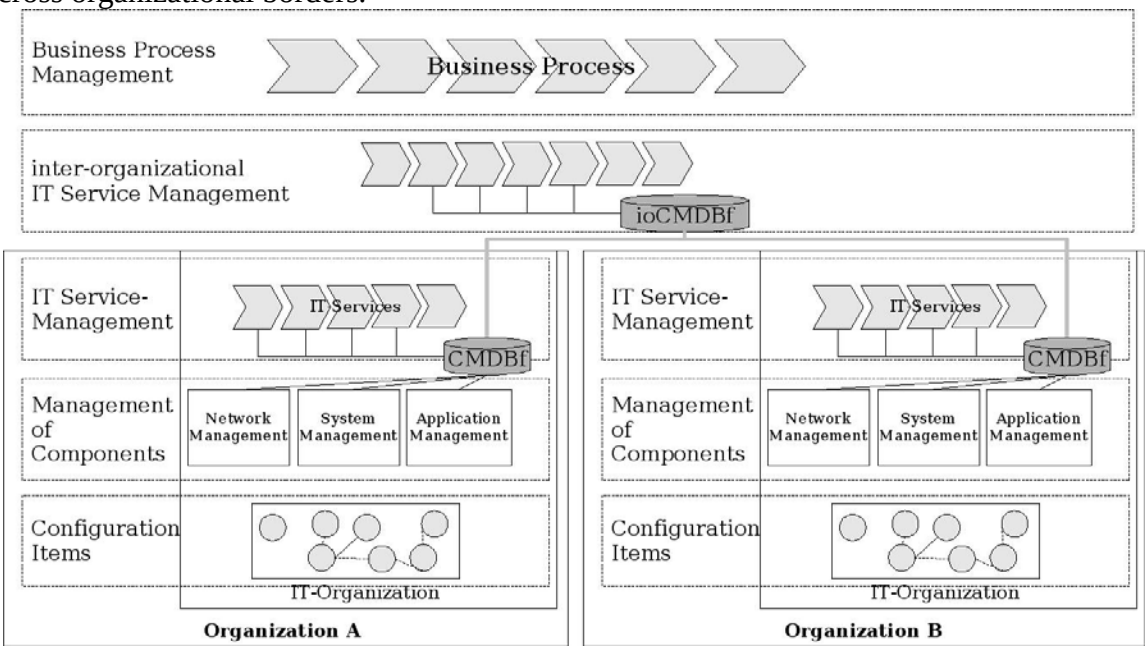

Figure 2: The ioCMDBf is Fully Integrated into the Management Layers

As can be seen from Figure 2, it is essential for the ioCMDBf to have interfaces to each local CMDBf that is deployed within each participating organization. Obviously, data protection aspects are vital because it will often be necessary for external users to have selective access to local data [13]. For this reason we have presented a policy-based access model based on Federated Identity Management (FIM) and Attribute Based Access Control (ABAC) in previous work [8].

4.2 Results of Inter-Organizational Service Management Process Enhancements

A holistic specification of the ioITSM process enhancements would go beyond the scope of this paper. Therefore we will describe the extension and redesign of ITSM processes on the examples of CM and Incident Management in this section.

Following the core ITIL specification [1], the main activities of CM are "management and planning", "configuration identification", "configuration control", "status accounting and reporting", and "verification and audit". For the inter-organizational case, we show the

necessary extensions based on the example of “status accounting and reporting”. While the former activities of CM are more on a strategic level we chose the operational activities of “status accounting and reporting” to outline the interactions with the ioCMDBf.

The main task of this process activity is to document the state of CIs in all of their life cycles phases. In the case of changing a local service’s CI, which has an impact on the inter-organizational service, figure 3 shows the core activities of our redesigned ioITSM process. A local change could be requested within the scope of either a Request for Change (RfC) or a Standard Change, the latter being formally approved by Change Management in advance (also known as pre-authorized change). In GÉANT2 a Standard Change could for example be a customer’s request for establishing a new end2end link. In the process of CM this change becomes visibly within the task of “RegisterCI”. The local Configuration Manager has to approve this registration and also decide whether any of the inter-organizational services is affected by this change. Such an approval process can be semi-automated if there are appropriate policies and decision rules in place. If an inter-organizational service is affected by this change in the CMDB, the “RegisterCI” activity also has to take place in the ioCMDBf. According to the circumstances, policies need to be defined between CM and ioCMDBf to specify the workflow and consequences, for example, if the registration on either of these sides is missing. This process of status correlation has to be done on the local as well as on the inter-organizational level: In the case of our scenario GÉANT2, this reflects the reality that any local changes could be initiated at each of the 30 involved NRENs.

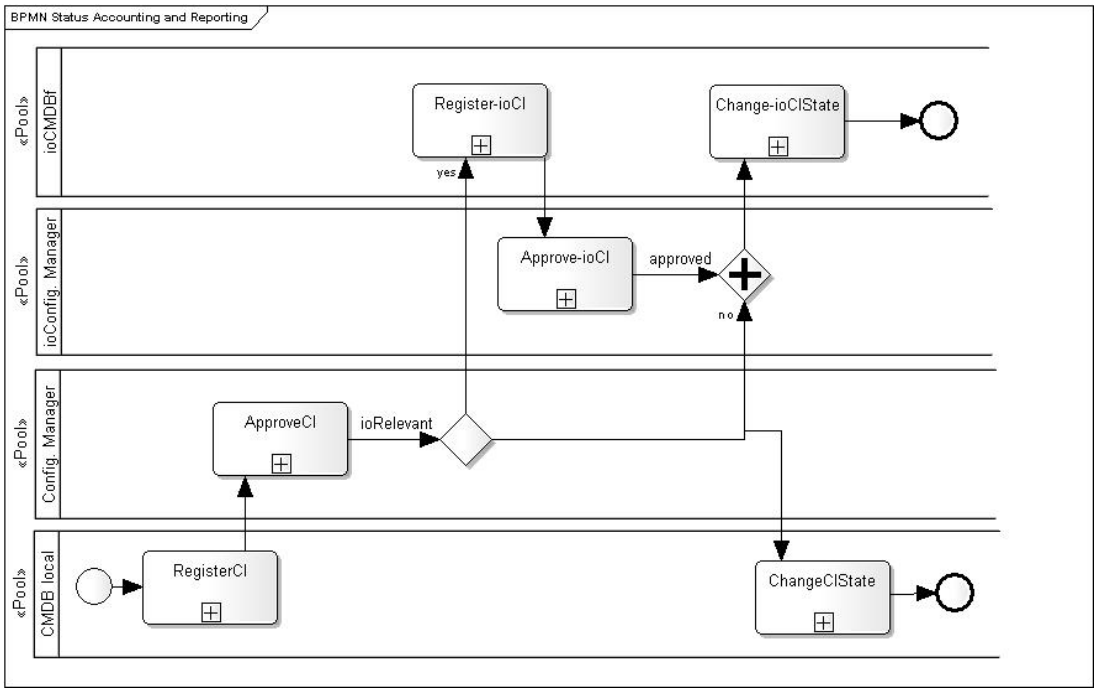

Figure 3: Configuration Management - Status Accounting and Reporting

From the user’s perspective, changes and service requests must be submitted to the ioServiceDesk. There the request is approved according to the defined policies within the ioCMDBf, e.g. to figure out whether the user is sufficiently privileged. If this is the case, the corresponding Standard Change procedure is started. In the case of end2end links in the GÉANT2 example, the corresponding local Standard Change procedures are handled via each involved organization’s local Service Desk. If the service instance is established successfully, it is necessary that both the local CMDB as well as the ioCMDBf are updated accordingly.

Figure 4 outlines the workflow within the inter-organizational Incident Management process. An Incident Detector reports an incident to the ioServiceDesk. For existing inter-organizational services, it is necessary to introduce this as a new role. It is possible to delegate this role to a local organizational unit, as it has been realized for example in the case of IntegraTUM, where TUM's Service Desk also acts in the role of the ioServiceDesk. Alternatively, a dedicated ioServiceDesk has to be created, as for example in GÉANT2. The activity "DetectIncident" is split into several subprocesses (indicated by the +signs in the diagram), since incidents might be detected either from users or event monitoring systems. These further activities, which are also handled by the ioServiceDesk, are following the Incident Management process description according to ITIL [2] and are not discussed here.

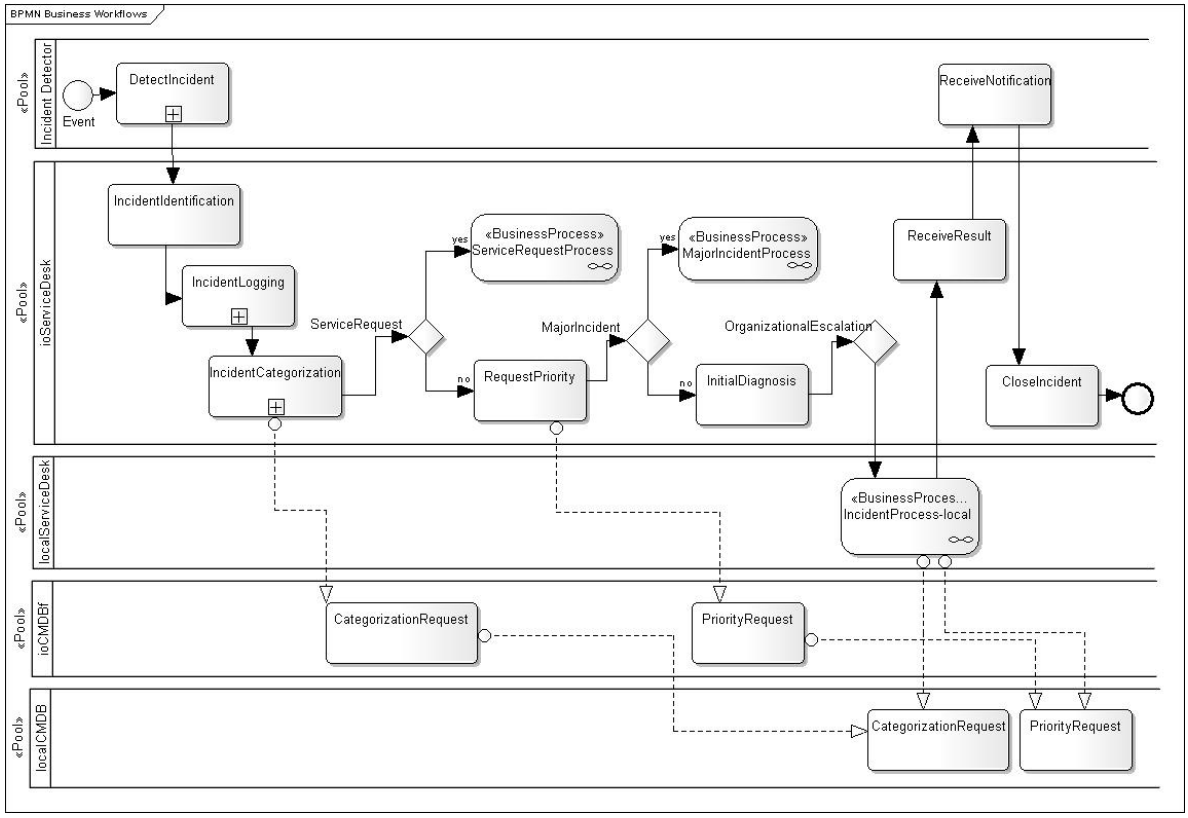

Figure 4 :Inter-Organizational Incident Management Process

The main difference to traditional Incident Management lies in the processing step of "IncidentCategorization", which determines the set of affected services and resources; hence, the ioCMDBf needs to provide the required input for this process, e.g. which of the involved organizational units are responsible for each subservice. A new business process instance needs to be initiated if the process determines that a service request instead of an incident needs to be handled, such as a customer's application for a new end2end link in GÉANT2. In local Incident Management processing, hierarchical as well as functional escalation mechanisms are already present for the exceptional case that the first level support cannot solve an incident. In the ioITSM case, we propose that an additional Organizational Escalation workflow has to be defined: Incident records will be passed on to the appropriate organizational unit, which can handle the request. In figure 4, this is depicted by each organization's local service desk; however, in existing implementations such as GÉANT2, it will be the support contact for any of the 30 NRENs. The ioCMDBf is required to support these processes in order to categorize the incidents correctly and link them to the affected services. Furthermore, the ioCMDBf needs to be connected to each local CMDB in order to synchronize the data; for example, if a subservice's CI reports

downtime due to a scheduled maintenance task, incident reports by inter-organizational service monitoring can safely be ignored regarding escalation mechanisms, and the users can be informed accordingly.

5. Business Benefits

The ioCMDBf supports the management of inter-organizational IT services in the same way local CMDBs support the intra-organizational ITSM processes. Both the service providers and the users benefit from it as discussed in this section.

By retrieving Incident Management information for categorization purposes from the ioCMDBf, any subsequent organizational escalation will be much more efficient. Similarly, it will be avoided that trouble tickets are forwarded to the wrong organizational unit. Therefore, incidents will be solved faster, thus increasing the service's availability and the overall customer satisfaction. The introduction of an ioServiceDesk as a new ITSM role offers a single point of contact for inter-organizational services and simplifies the communication between the involved organizations, because the ioServiceDesk coordinates the necessary work tasks. In GÉANT2, this easily scales to all involved organizations of the 30 participating NRENs.

The Change Management can plan the handling of changes much easier, because an inter-organizational Change Advisory Board will coordinate maintenance time slots, and thus the impact of local changes to inter-organizational services can be anticipated reliably and efficiently. As an example, in the IntegraTUM scenario, changes to the central Identity Management System, which is operated at LRZ, must not be made during the online-application phase for study courses, as the TUM's business processes might severely suffer from any service failures. Such service dependencies can be derived from the ioCMDBf, which provides the required input for CM, resulting in a win-win situation for TUM, LRZ, and the customer.

Regarding Financial Management, the ioCMDBf gives an overview of which CIs are used by which services and which customers, and thus is the base for accounting and billing. In the Grid environment, it supports the assignment of virtual to real services and resources, and thus helps to develop a fair sharing of costs and expenses depending on the actual service usage.

The ioCMDBf also provides vital input for the design of Service Level Agreements and the optimized arrangement of service portfolios; while respecting the related business aspects, a detailed model of the infrastructure is provided in a way that SLAs can be adapted to changing customer requirements as discussed in [14].

6. Conclusions

More and more inter-organizational business cases require inter-organizational IT services and consequently a whole new class of ITSM processes. However, as we have shown, ioITSM is currently not adequately tool-supported. To leverage existing infrastructures and to extend existing, well-working best practice frameworks, we have introduced the concept of an inter-organizational Configuration Management Database (ioCMDBf).

This paper presented several of the challenges related to ioITSM and discussed inter-organizational variants of Configuration Management and Incident Management. With the help of three different real world scenarios we have shown that regarding the management of inter-organizational services also the ITSM processes need to be extended, i.e. that new roles like the ioServiceDesk and the ioConfiguration Manager have to be introduced; they cover relationships and activities between local and inter-organizational processes. Furthermore, the activities between the concerned parties have to be adapted.

Our research team is spread over various organizations (see http://www.mnm-team.org/) and taking part in the above described scenarios within Grid, network, and outsourcing projects. Thus one of our current research focal points is inter-organizational ITSM, including both the process design and the technical architectures. Our future work concentrates on the further definition and refinement of the inter-organizational ITSM processes as well as the Configuration Management process specification with the design of the ioCMDBf's interaction model. We also plan to apply our approach to non-public use cases in telecommunication industry.

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