A Quantitative Study on the Influence of ASON/GMPLS on OPEX

Andreas Kirstädter, Andreas Iselt, Christian Winkler, and Sandrine Pasqualini

Abstract **ASON/GMPLS is promoted as one of the key technologies to reduce Operational Expenditures (OPEX) of network operators, since it provides the tools for automating the network operations. This paper gives a detailed model and qualitative analysis of the major OPEX-affecting operation processes in the area of core and metropolitan area transport networks. Moreover, a first quantitative evaluation of the changes in the operational efforts induced by ASON/GMPLS is described. The evaluation shows a significant potential to reduce OPEX, which is to some extent independent of the type of operator.**

Keywords **GMPLS, OPEX, network management, network operations, business case**

1. Introduction

ASON/GMPLS is often promoted as a way to reduce Operational Expenditures (OPEX) of network providers. However, detailed analysis and quantitative evaluation of the changes induced by such technologies is rare. In this paper we quantify the cost reduction potential of ASON/GMPLS. We start with a detailed analysis and modeling of the most technology dependant and OPEX affecting processes within the traditional structure of operators. Then we describe the process changes to be expected by the introduction of ASON/GMPLS [1]. Based on a survey with several operators, a quantitative evaluation, based on a survey with several operators, of these OPEX changes is then provided.

2. Approach

To identify the cost influence of the ASON/GMPLS automation technology, interviews with network operators about their current operations processes have been carried out. Based on these a generalized process model has been defined. This nodel was parameterized with time and cost values derived from surveys of several operators. The total expenditures of a company can be split in capital expenditures (CAPEX) and operational expenditures (OPEX). CAPEX relate to the fixed infrastructure [2] and are depreciated over time. OPEX [3] represent the cost to keep the company operational and include costs for technical and commercial aspects of operations, maintenance, administration, etc. Network operation comprises all the processes and functions needed to operate a network and deliver services to customers. For the traditional network, we assume that it provides end-to-end services, such as leased lines. This paper focuses on the impact of ASON/GMPLS on network operations in a network that is up and running [4]. We therefore don't consider the costs of the initial installation and those of network extensions. In this study we perform a process-based analysis of the OPEX reductions to be expected for network operators using ASON/GMPLS. The idea is to evaluate how traditional processes can be automated taking advantage of ASON/GMPLS features. Based on this qualitative modelling, quantitative results are then calculated.

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3. Considered Processes

Since the service management will be affected most by the automation capabilities of ASON/GMPLS we investigated the interactions and operations of sales department (SD), administration (AM), project management (PM), network operation (NO) and external suppliers (ES) within the traditional structure of network operators.

- **Service Offer:** The sales department negotiates the terms and conditions of the offer with the customer. In case of non-standard connection inquiries, a separate individual projecting (PM) is triggered for the various domains (local, internal, external)causing additional effort and delay. The result of the price calculations (SD) is sent to the customer.
- **Service Delivery:** The sales department (see Fig. 1) handles the contract administration and forwards it to the project management for the network domains involved. After provisioning and end-to-end testing (PM) customer care, billing, and alarm management are activated (AM) and a delivery report is issued (SD) to the customer.
- **Service Cease:** Triggered by the end of a contract or a cessation request PM triggers the deactivation of the circuits (NO) and the recovery of

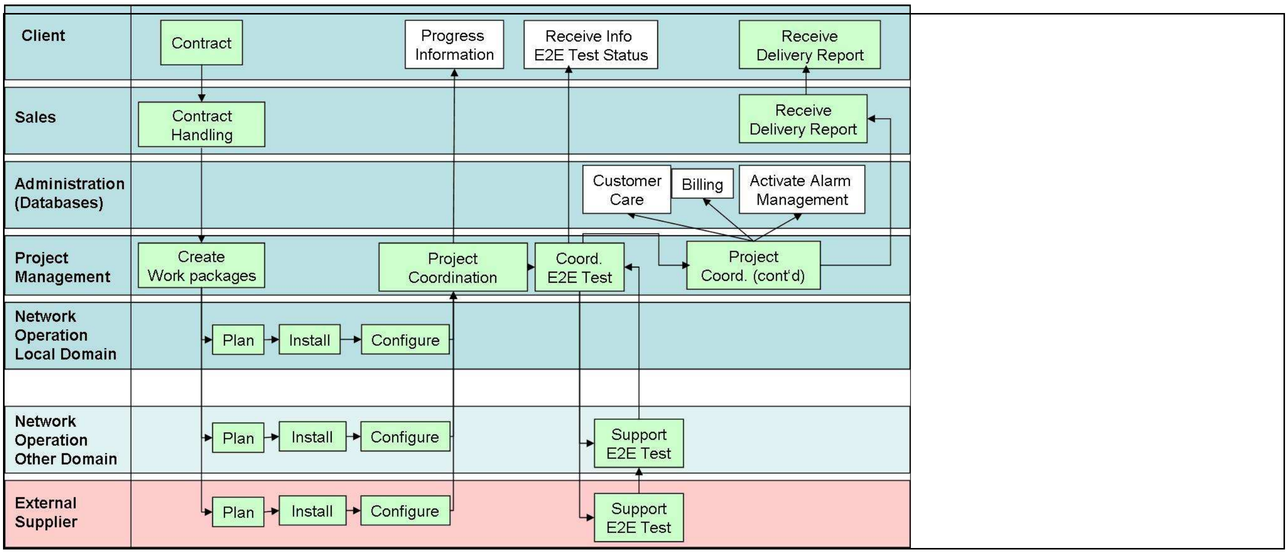

Fig. 1. Typical service delivery process.

deployed equipment (NO). SD is informed about the expected cessation and the final bill is sent out (AM).

- **Service Move or Change:** Moving or changing a connection involves all three previous processes: Contract update, new connection setup, and release of the previous one. Within the service-offer part again the availability of resources is checked. SD generates orders for provisioning and cease - both being implemented via PM and NO.

4. Impact of ASON/GMPLS

ASON/ASTN are protocol-independent control plane architectures, which are standardized by ITU [5, 6]. GMPLS is an IP-based control plane protocol suite standardized by IETF [1]. Both ASON/ASTN and GMPLS use distributed real-time signalling and routing algorithms that allow clients to setup, configure, and release (unprotected or protected) connections automatically via standardized interfaces. Automating the network operations will significantly reduce manual intervention and the involved costs for connection handling. Network data, configuration commands, and confirmations are automatically created and exchanged by signaling (via UNI and NNI) and routing protocols. Thus, the service offer process and provisioning process will change fundamentally [5]: To allow an automated service delivery that is executed mostly on a pure machine level correct agreements and regulations in the form of detailed Service Level Agreements (SLAs) have to be negotiated by SD. ASON/GMPLS technologies are strongly connected to the possibility to offer dynamic services. This may strongly influence pricing and billing: Fixed price services, e.g. leased lines, will definitely be cheaper in pricing and billing than dynamic services. The latter require more effort for price calculation and assignment to customer accounts - indicated via the term *negotiation* in the processes below.

- **SLA Negotiations:** Before services are ordered and delivered, a contract framework specifies in detail all sections of a generic service template. SLAs specify not only technical aspects as bandwidth, service availability, and quality of service but also legal and organizational items (penalties for requirements not met, compensation, tracking, and reporting, etc.). Within the network operator, this is accompanied by forecasts (SD), Planning (PM), and adaptation of the infrastructure (NO).
- **Service Delivery:** After this, the service delivery process can be simplified via the introduction of standardized interfaces (Fig. 2). Manual intervention is necessary if no positive responses were received. After a database update (AM), customer care is informed, and billing and alarm management are activated. At the end of this process, the client receives the delivery report. Note: In contrast to the standard service delivery process no end-to-end testing is assumed to take place here.
- **Service Cease:** After receiving the cessation request via the UNI it is also assessed by SD and confirmed to the client together with a bill. NO ceases the physical connection and confirmes to PM.
- **Service Move or Change:** after the initiation via the UNI the availability of resources and the conformity of this request within the SLA contract are checked automatically. If both have been answered

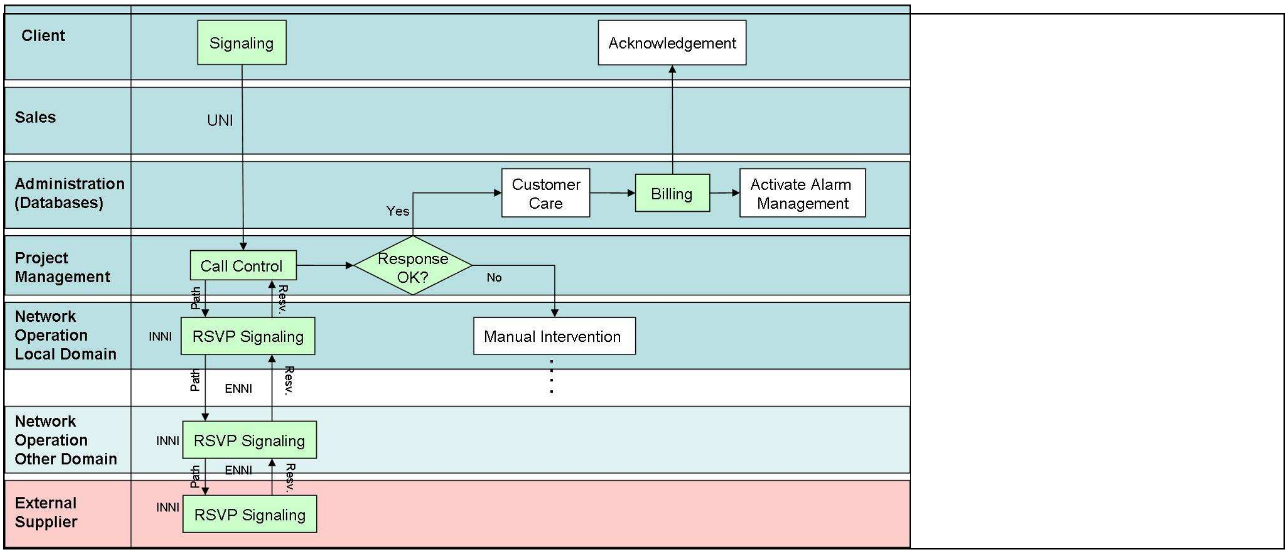

Fig. 2. Automated service delivery process.

positively the corresponding cease and provisioning steps are handled directly via the control plane. Manual intervention is only necessary if additional resources have to be deployed in the network or if the request exceeds the SLA framework.

5. Quantitative Results

For each of the processes described in [4], costs have been assigned to the process steps (boxes in the figures above) and a probabilities to the branches. We focused on labour costs expressed in terms of hours required to carry out the task described in the box. Then we calculated the hourly fully accounted cost [7] of each kind of employee, and multiplied it by the number of hours. We distinguish several personnel categories: Sales, administration, engineers, and technicians (in the NOC or field technicians). Each department displayed in Fig. 1 and Fig. 2 is composed of one type of employee, except the NOC where engineers, technicians, and field technicians have been considered. Summing up costs for all steps gives then an upper-bound estimate of the overall cost of a given process. Cost and effort figures for operations were collected based on surveys and interviews with several carriers. From these figures we extrapolated the figures for the ASON/GMPLS processes. In the case of a typical incumbent operator (Fig. 3), the service offer process involves expensive sales and availability checks operations. In the end it is nearly as expensive as the service provisioning itself. The cease process involves nearly no work from project management and network operations center, which explains why it is much cheaper. The move and change pro-

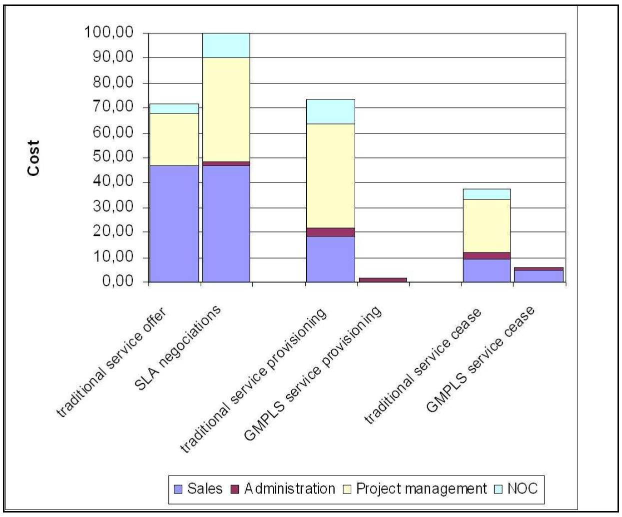

Fig. 3. Relative costs for a non-standard service.

cess is the combination of service offer, provisioning, and cease (in principle, it is a little more expensive since it requires some more coordination). Looking at the ASON-modified processes, we first notice that SLA negotiations are more expensive than the traditional service offer. This is to be expected since the former includes some operations that are usually carried out in the service provisioning process (plan, install and configure equipment). For a fair comparison, one needs to compare the combination of service offer and provisioning. In the case where GMPLS is used, project management and sales are involved only once - when the SLA is setup - leading to substantial savings. Another advantage is that the same SLA can serve for several services. So once the SLA is in place, provisioning several services with GMPLS costs much less. The results show that reductions of operational efforts and thus costs can be expected with the automation of the service delivery as is provided by GMPLS/ASON. The main reductions are in the provisioning and cease process, where traditionally a lot of human interaction was necessary. With the introduction of signalling the setup and release of connection is simplified and costs are reduced accordingly.

6. Conclusion

Due to a considerable high effort for surveys and interviews with multiple carriers this investigation goes one step beyond the general claims of advantages of ASON/GMPLS. As a result most network operators' processes are similar and can be modelled quite generically. Reductions of OPEX effort for these processes and therefore cost reductions in the order of 50% compared to traditional operations can be identified with ASON/GMPLS. Based on these results the introduction of ASON/GMPLS can generally be recommended to significantly reduce OPEX. This advantage can even be improved, if all network domains and all network layers support interworking ASON/GMPLS control planes and hereby also reduce the operational costs for end-to-end connections across multiple operators' domains.

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