Cost Structures of Transport Networks

Dipl.-Ing. Robert Prinz, Lehrstuhl für Kommunikationsnetze, TU München, Deutschland

Dipl.-Ing. Dominic Schupke, Lehrstuhl für Kommunikationsnetze, TU München, Deutschland
Dr.-Ing. Dipl.-Wirtsch.-Ing. Andreas Kirstädter, Siemens AG, München, Deutschland
Dr.-Ing. Andreas Iselt, Siemens AG, München, Deutschland
Dr.-Ing. Achim Autenrieth, Siemens AG, München, Deutschland
Dr.-Ing. Bernhard Edmaier, BT Ignite GmbH & Co, München, Deutschland

Abstract

We discuss automatic switched optical/transport networks (ASON/ASTN [1][2]) with respect to cost structures. Based on the application of the value chain model of Michael Porter [3] to network operators' processes and activities, we elaborate on the advantages of automation using standardized network interfaces and a decentralized control plane. Furthermore, new business opportunities enabled by ASON/ASTNs are investigated.

1 Introduction

In the course of the development of automatic switched transport networks (ASTN) and, as the special case, automatic switched optical networks (ASON), it becomes important to be aware of the cost structures of these networks, and to identify the main points where such a concept offers improvements in the network and new business opportunities. In this paper we make an approach for this by using the value chain model.

The next section explains the concept of ASTN and ASON. Based on the general concept of a value chain in Section 3, we detail the value chain of a network operator in Section 4. This scheme will be used in Section 5 to identify the improvements when deploying ASON/ASTN in transport networks. Besides these improvements, Section 6 presents several new business opportunities with ASON/ASTN. Finally, Section 7 concludes this paper.

2 Overview of ASON/ASTN

ASON and ASTN are protocol-independent control plane architectures, standardized by the International Telecommunication Union-Telecommunication (ITU-T) [1][2]. They are intelligent client-server models that allow clients to setup, configure, and release connections automatically.

Networks with ASON/ASTN technology are hierarchically structured. The network can be segmented into administrative domains (e.g. different carriers). Each domain may consist of several routing areas, e.g. to cluster different types of equipment or to match geographic regions (see Slide 4).

As illustrated in Slide 5, the architecture is structured in three planes: a management plane, a control plane, and a transport plane.

The management plane is typically organized in a centralized manner using a few Network Management Systems (NMS) and supports common management functions.

In contrast to the management plane, the control plane will be realized in a distributed fashion. It contains the main functionalities of the ASON/ASTN technology: Integrated functions for call and connection control offer a fast, efficient, and secure way to configure data connections in the transport layer network (see slide 6). The transfer of the client signal is realized by the transport plane equipment. But also management and control messages can be transmitted on the transport plane level.

To realize the communication between client and network entities different interfaces are defined by ITU-T.

The user network interface (UNI) enables the user to establish, configure and release connections. The supported information elements are end-point address and name, authentication, connection admission control (CAC), and connection service messages (CSM).

The reference point between domains with an untrusted relationship is called external network-network interface (E-NNI). It supports information elements like reachability of network addresses, authentication, CAC, and CSM.

The inner domain interface is called internal network-network interface (I-NNI). In addition to the supported information elements of the

E-NNI it has to provide topology and routing information.

3 The Value Chain Concept

To evaluate possible cost savings of ASON/ASTN and to derive competitive advantages it is first necessary to analyze the cost structure and the business models of a typical network operator.
A systematic approach to analyze the cost structure of a company is the 'Value Chain' model presented by M. Porter in the book "Competitive Advantage" [3]. The "Value Chain" sees a company as sequence of value-adding activities to design, produce, market, deliver and support products or services. Throughout many industries (e.g. power and automotive industry), this concept has been used to identify and analyze the key sources of competitive advantage by considering the differences among competitor value chains and chain interactions.
The value chain in the upper part of Slide 7 shows the total value (the amount buyers are willing to pay for the product or service) and consists of primary and secondary activities (building blocks to create a product) and margin (difference between value and costs of activities).
Primary activities are the activities involved in the physical creation of the product and its sale and transfer to the buyer as well as after-sale assistance. They can be divided into five generic categories:

- Inbound Logistics: Activities like receiving, storing, and disseminating inputs in context of the product
- Operations: Transforming inputs into the final product
- Outbound Logistics: Collecting, storing, and distributing the product to buyers
- Marketing & Sales: Making the buying of the product possible and attractive for the consumer
- Service: Providing service to enhance or maintain the value of the product

The primary activities are complemented by support activities. These include purchased inputs, technology, human resources, and various firm-wide functions. To analyze the value chain it is necessary to identify the activities with a significant proportion of cost or a high impact on the expected competitive advantage of the company.

4 Network Operator and Customer Value System

The typical interaction model between network providers and between network providers and customers is depicted in the lower part of Slide 7.
Transport network operators own or lease fiber infrastructures that they operate currently mostly with WDM and SDH/SONET. They may sell transmission capacity directly to end customers but often also sell to other carriers. These carriers retail the capacity to end-customers or even to other carriers or retailers.

5 Advantages with Control Plane Automation

With the automation that is offered by the control plane technology improvements in the single value chains as well as in their interactions can be achieved. Most improvements are expected for carriers, customers, and retailers. Transport network operators will still have to provide the rather inflexible physical network infrastructure.
All primary activities of the value chain can benefit from ASON/ASTN:

- The standardized interfaces (UNI, E-NNI) between network operators simplify the **inbound logistics**. The procurement process will be simplified, automated, and accelerated. This leads to procurement cost reductions. Moreover, the fast order and delivery process reduces the storage costs. These costs may also be reduced by the introduction of technologies providing bandwidth on finer granularities.
- The **operations** are improved by the automated provisioning process introduced by the I-NNI. With the introduction of control planes in transport networks it is possible to introduce new resilience mechanisms, which have the potential to reduce the required bandwidth for (unused) backup resources. Moreover, the automation will ease the offering and provisioning of multiple resilience classes.
- The **outbound logistics** also benefit from a control plane by the automated delivery of services. E.g., the order processing can be simplified and automated.
- **Marketing & Sales**: The simplification of the sales, ordering and delivery

processes increases competition amongst operators, since customers have the opportunity to choose one supplier for a required service.

- The ASON/ASTN approach can help to improve the **service** on the product 'transport data connection' by the potential of introduction novel fault tolerance features.

6 New Business Opportunities

ASON/ASTN technologies might well change today's transport network market by enabling new business opportunities. Some of them are explained in the following paragraphs:

The standardization and automation of the interfaces between supplier and customer (described in the previous sections) facilitate the provisioning of "service on demand" (see Slide 9). This fast and just-in-time delivery of bandwidth not only leads to cost reduction possibilities at both the supplier and its customers. It also offers those operators who install ASON/ASTN solutions a competitive advantage by differentiation from others who cannot deliver in such short time intervals.

The customers in turn may then generate more revenues by offering to their own customers more attractive conditions like faster service delivery, more flexibility or more competitive pricing - all enabled by the dynamic provisioning of bandwidth.

Global network operators almost always have to interact with regional ones to reach the end customers. Standardized ASON/ASTN interfaces not only allow a fast and flexible bandwidth delivery. They also offer the possibility to greatly reduce the transaction costs in doing this. An important example is end-to-end Layer-1 Virtual Private Networking, illustrated on Slide 11, which allows a secure and protocol-independent interconnection of customer premises. For this purpose several companies might integrate their information infrastructures via these standardized interfaces. They are then forming an integrated value system - also denoted as a virtual company [3] - that is able to easily cover novel or geographically distinct market segments (see Slide 10).

The reduced transaction costs will also bring virtual marketplaces into life. Here operators will sell and lease transport-network bandwidth making efficient bandwidth brokerage a new business opportunity.

7 Conclusion

In this paper we have shown that the general value chain model can very well be applied to network operators. Moreover it has been shown that network operators typically form a value system from transport bandwidth "production" to retailers and end customers. Our investigations indicate that the ASON/ASTN technology allows automating the processes within single network operators as well as between operators. Besides the reduction of effort enabled by the automation there are also improvements for the capital requirements of carriers and bandwidth retailers that can obtain bandwidth on demand instead of holding bandwidth on stock for possible customer demands. Finally the new technology does not only improve processes and reduce capital requirements but also enables new, flexible services for end-customers.

References

[1] ITU-T prepublished Rec. G.8080/Y.1304, Architecture for automatically switched optical network (ASON), November 2001.

[2] ITU-T Rec. G.807/Y.1302, Requirements for automatic switched transport networks (ASTN), July 2001.

[3] M. E. Porter, Competitive Advantage, London, Collier Macmillan Publishers, 1985