COMCON: Use Cases for Virtual Future Networks*

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Abstract. In the Future Internet, a multitude of networks will coexist and complement each other. These networks allow specialization but require isolation of functionalities in order to provide dependable and predictable networks. This allows different networks to run in parallel but isolated from each other. Additionally, network resource scalability is supported to reduce the time and overhead required to introduce new services. The objective of the COMCON (COntrol and Management of COexisting Networks) project is to design novel control and management mechanisms that support the coexistence of networks in a future networking scenario and to illustrate the economic advantages. In this contribution we present three use cases defined in COMCON, which serve as a guideline for our virtual network architecture.

Keywords: Future Internet, Use Case, Virtual Network.

1 Introduction

In the Future Internet, a multitude of networks will coexist and complement each other. These coexisting networks allow specialization but require isolation of functionalities in order (a) to provide dependable and predictable networks (e.g., a banking network), (b) to allow different network technologies to run in parallel, but isolated from each other (e.g., coexistence of 3G and different beyond 3G mobile networks on the same physical infrastructure), and (c) to support network resource scalability to reduce the time and overhead required to introduce new services (e.g., to support the seamless transition from a limited liability beta service to a fully operational resilient high-demand service). Each network should be able to run its own specialized protocols that may fundamentally differ from

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today's Internet Protocol (IP) stack. Network virtualization is considered to be a key technology to realize coexisting networks.

The objective of the COMCON project (COntrol and Management of COexisting Networks) is to design novel control and management mechanisms that support the coexistence of networks in a future networking scenario and to illustrate the economic advantages. Virtualization technology is a key component that not only acts as an abstraction layer between services and infrastructure to facilitate innovation, but also is an integral part of the overall design to support the evolution and coexistence of different network architectures. Towards that goal, interfaces between functional roles in coexisting networks, realized by network virtualization, are specified. A provider- and operator-grade management and control function of coexisting virtual networks is built. It comprises of isolation, dynamic reassignment of resources, and efficient and effective monitoring of virtual networks. The requirements for the network reference architecture in the COMCON project is derived from a set of unique use cases. These use cases help to design, evaluate and verify the reference architecture during the design process in an iterative way.

2 Use Cases to Evaluate the Reference Architecture

Among others, we have defined the following use cases: Service Component Mobility, Service Broker, and Beta Slice.

The Service Component Mobility use case considers dynamic migration of service components in a virtual network. Moving or reproducing virtualized components geographically closer to the user enables two kinds of improvement. On the one hand, the relocation of resources might improve the delay, jitter, and other quality of service parameters. The QoE of the user increases accordingly. On the other hand, the relocation can optimize the utilization of network components. If the network is monitored and it is reported that the number of customers using the service from a distant location exceed a certain threshold, the relocation may free capacity on long distant links. This relocation may make sense also from a economic perspective.

The Service Broker is realized as a network component, which knows about the user's needs and selects and bundles services from different providers. Thus, it is the 'single face' of the virtualized networks to the customer and chooses the virtual network costs according to the user's needs in terms of costs and network quality. In this use case we consider a scenario, where the network virtualization is extended to the end-customer. Different virtual network operators (VNOs) compete with their services and the end-customer is free to select a different VNO for each network service he wants to use. For example he might want to watch IPTV using a premium video transfer service provided by one specific VNO. His VoIP and gaming services are delivered by another VNO, which has specialized on low-delay-connections with small bandwidth requirements. However, the peer-to-peer traffic is handled by a VNO that provides only best-effort data transfers with 90% availability, but charges on a cheap flat rate basis.

The Beta Slice enables the creation and testing of new services without the additional cost of setting up a specialized test bed. Often the evaluation of new services in a specialized test bed environment is too expensive. Hence, the new service is never implemented. The Beta Slice is a special purpose virtual network to solve this problem. A new service is launched within a small dedicated virtual network, which restricts the access to a small group of initial users. After the service has been tested successfully, the virtual network can be extended progressively to a full operational network. This way, roll out costs are decreased and expenditures for test bed evaluation are saved. Another aspect is that the time-to-market of the new service may be significantly decreased.

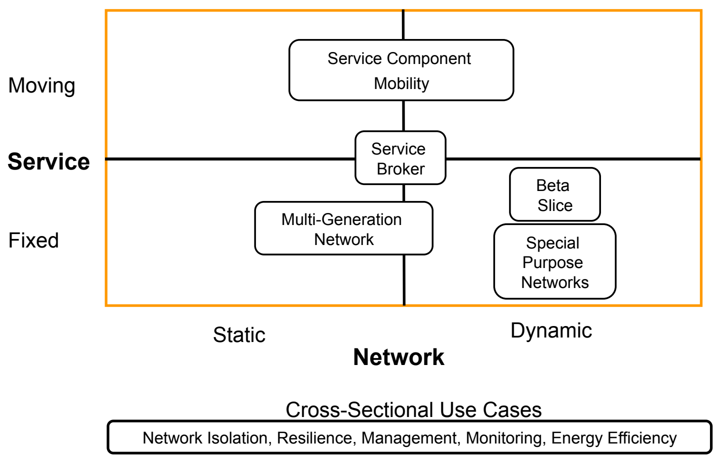

Fig. 1. Clustering of Use Cases

Figure 1 depicts how the use cases differ according to service mobility and network dynamics. The Beta Slice is a good example for a use case, which changes the network size rapidly but does not vary in terms of the service delivery. In contrast, the Service Component Mobility use case is very dynamic in terms of service delivery. The numbers of users is expected to vary over time, but the mean value is considered to be only changing slightly. The Service Broker use case is somewhere in-between. The number of networks attached to the user as well as the the service delivery will change from time to time but not completely.

3 Conclusion and Outlook

Based on these and other defined use cases, the COMCON project will design novel control and management mechanisms for coexisting virtualized networks. We show initial project results derived from the evaluation of the use cases. Moreover, potential business impact will be illustrated.