Towards Cloud-Ready Transport Networks

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***Abstract*— Operators are challenged by the new cloud services, which can modify current traffic pattern. This talk presents the Telefonica I+D view on the evolution towards a transport network ready to support cloud services. It explains the reasons why current transport networks are not efficiently design for a cloud environment and it describes the architecture for a cloud-ready network. To show the feasibility of such cloud-ready network, experimental validations are presented to show the concepts of a cloud-ready transport network.**

I. EXTENDED ABSTRACT

Cloud computing paradigm provides a new model for service delivery where (physical or virtual) computing resources can be provided on-demand. This elasticity permits the sharing of resources among users, thus reducing costs and maximizing utilization.

Under this new model, the resources can be allocated in separated data centers, being accessed by means of a telecom operator network. Thus, the network becomes the key point to efficiently connect users to services and applications, which now are consumed independently of where either the resource or the user is located. The location of the services is not any more tightly bound to a small number of nodes, topologically and timely changing. The network utilization becomes then time-varying and less predictable.

The new capacity demands advocate for an evolution to optical transport based solutions [1], and a major cooperation between network layers, introducing a multi-layer dimension to the problem.

In order to successfully respond to the new service context, a cloud-ready transport network must support procedures to allow elastic on-demand connectivity as a way to configure the network based on the changing demands, to provide an automated connectivity control to use dynamically the network resources, and to enhance the network configuration based on the cloud information. A cloud-ready network can achieve these goals with the support of three technological pillars, described below.

A. Flexible transport network

Current transport networks provide a static infrastructure grooming and carrying any kind of client data in a reliable way. Network capacity over-provisioning is usually needed for guaranteeing traffic demand, transforming these connections in big static "fat pipes". However, new mechanisms are needed to provide the required elasticity imposed by the cloud computing services, supporting reconfiguration and adaptability of the transport network to make possible the transfer of big chunks of data among centers in different sites with a changing traffic demand, adapting to the needs of the services in a cost-efficient manner [2].

B. Multi-layer oriented network management

The high and variable capacity needs associated to cloud computing based services are questioning the scalability of current IP-based network architectures in terms of cost per bit.

A promising alternative is the use of optical networks, which have the potential to drive down the network costs. IP and MPLS technologies take advantage of statistical multiplexing of Internet traffic profile, while on the other hand the cost of optical switching is cheaper than electronic switching when a certain amount of traffic is aggregated. A Multi-layer Network control can optimize the usage of resources in IP over WDM networks as the basis to build such economically efficient network architecture [3].

C. Cross-stratum approach

The current service provisioning for cloud applications is totally agnostic about the conditions experienced by the underlying network. As consequence, the applications could cause an inefficient use of the network resources, and finally, a mismatch on the expected quality expectations of the final consumers of those applications.

To solve this gap it is necessary a more tight coordination among the application and the network in such a way that both application and network resources are jointly considered when allocated during the communication lifetime. This cross-stratum cooperation will not only improve the efficiency in the resource utilization, but it also will permit to ensure a better user experience, and to deliver a more resilient service.

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