Chapter 1

Migration Path Towards Cloud-Aware Core Networks

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ABSTRACT

New services like Cloud Computing and Content Distribution Networks are changing telecom operator infrastructure. The creation of on-demand virtual machines or new services in the cloud reduces the utilization of resources among users but changes traditional static network provisioning. This chapter presents network architecture to deal with this new scenario called “Cloud-Aware Core Network.” A Cloud-Aware Core Network can request on-demand connectivity so the network is configured based on the changing demands. Secondly, the network has to dynamically control the network resources and to take into account cloud information in the network configuration process. The Cloud-Aware Core Network is based on an elastic data and control plane, which can interact with multiple network technologies and cloud services.

TOWARDS CLOUD-AWARE CORE NETWORKS

Data Center (DC)-based services are emerging as relevant source of network capacity demand for service providers and telecom operators. Cloud computing services, Content Distribution Networks (CDNs), and, generally, the networked applications have a huge impact on the telecom operator infrastructure. Cloud computing paradigm provides a new model for service delivery where computing resources can be provided on-demand across the network. This elasticity permits the sharing of resources among users, thus reducing costs and maximizing utilization, while posing a challenge towards an efficient cloud-aware network.

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The computing resources can be provided on-demand depending on the user requests. Such resources can be allocated on distinct servers into a data center, or through data centers distributed in the network. Under this new model, the users access their assigned resources, as well as the applications and services using them, through telecom operator networks. Additionally, thanks to the possibility of allocating resources in separated data centers, the network should dynamically connect users to services and applications, which now are consumed independently of where either the resource or the user is located. The versatile consumption of resources and the distinct nature of the applications running on it will produce very variable traffic patterns on the connections to the data centers.

**Current Network Architecture**

Traditional telecom networks have been built on the concept of totally managed services, with an end-to-end approach, where the telco operator is in charge, not only, of providing the necessary connectivity to the end user and the final service itself, but also of providing total control of the service provision, including tasks such as subscription management, billing, network operation and troubleshooting, quality of service guarantee, customer care, etc.

Such approach mandates a tight control of the service path, and a comprehensive understanding of the service and its implications. The telco operator offers those services to its customers, which merely consume them (even, in some cases, composing some of them) in a controlled manner, within the limits provided by the telco operator. These services can be seen as building blocks, which at the same time are supported by network building blocks, both at transport and control level, monolithically. The telco services are typically provided by centralized nodes located deep in the network. These service nodes are under the solely control of the network operator. Such controlled environment tends to remain stable where the innovation in technology and services is gradual and modulated by the network operator.

However, during the last decades, the technology fundamentals of the computer networking have been influencing the telecom networks, mainly due to the hegemony of the Internet Protocol (IP), which has been emerged as the technology substrate for every kind of service, also for the traditional services offered by telco operators.

The telco network is highly hierarchical and can be clearly differentiated in several components:

- The customer connection, which is the network level that allows the end customer (either residential or enterprise) to access the telecom services. Technologies like DSL or FTTH in the fixed broadband access, or LTE in the mobile counterpart can be considered as examples of that.
- The access network, which is the network level which collects the end user traffic demands, providing the needed capillarity to reach the customers. Typical elements of the access networks are DSLAMs, OLTs, etc, grouping end-user connections in an efficient manner.
- The aggregation network, which is the network level that distributes the traffic regionally. Current aggregation networks are mainly based on Ethernet technology, typically supporting MPLS-based transport services on top of it.
- The core network, which forms the backbone of the network that allows the communication among the rest of network levels. This part of the network is built-on high capacity optical networks and IP routers in charge of switching and forwarding packets at high speed rates.
- The interconnection network, which permits the interexchange of traffic with other networks managed by other operators. These are direct IP connections between powerful IP routers capable of handling a large database of Internet routes.
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