

Title: Deep Slicing and Loops in a Loop: Multi-Tenancy and Smart Closed-Loop Control Gone Wild

Abstract:

This talk shares a vision on some key characteristics and features of networks in 10+ years from now.

We will discuss how the concept of slicing --so much hyped these days-- may be only at the tip of the iceberg if we consider how deep network slicing can go, taking multi-tenancy to an extreme. Today's telecom infrastructure take timid approaches on sharing infrastructure assets (energy, space, hardware, etc.). As the history of multiplexing gains keeps proving, we shall expect deeper approaches to any-layer resource sharing, from virtualized infrastructures to applications and network functions in slicing operational modes where multi-tenancy goes wild. Such deep slicing vision is deep on both the vertical (multi-layer) aspect as well as horizontal (end-to-end and multi-domain) realms. We will present some exemplar approaches to this end. Furthermore, deep slicing takes Customer-Provider recursivity to an extreme and is characterized by unprecedented tenant-controlled operations, where slice tenants have the choice on the network protocol stack and actual software instances under its responsibility.

As we move to software-based and shared-resource networking modes of operation with network slicing being the norm and changing the economics of connectivity business and the transformation of industry verticals, decentralized programmable networking environments will be characterized by diversified boundaries of points of traffic exchanges (e.g., From autonomous systems to intelligent transportation system (ITS), virtualized Customer Premises Equipment, IoT / FoG). These edge-driven dynamics (From monolithic to micro services coexistence of networking functions in diverse networking environments) call for cognitive peering based on new models of exchange of information for peering among networking domains, e.g., fully-automated exchange of "needs" to become traffic exchange "resolution" characteristics at run-time.

Another sub product of these developments are the new resulting control loops, where more centralized SDN type of control will co-exist with multi-access edge computing. 5G decentralizes radio access technologies (RATs) creates a midhaul, where users can interact with multiple mobile service providers, unlocking diverse RAT offloading conditions, including in-network programmable edge data paths (e.g., P4 pipelines running advanced control programs for optimized mMTC).

Scheduling algorithms control RATs in short-time control loops according to low-level hyperparameters optimized through machine-learning algorithms. For instance, semi-oblivious traffic engineering loops can offload edge and core mobile according to high-level hyperparameters in a mid/long-time control loop. The challenges behind lifecycle management of "looping" hyperparameters will be understood and scheduling coordination will be in place based on learning rates of hyperparameters based on access states e.g., seasons, time of the day, region, programmed events, topological particularities and mobility.