Leveraging Multipath TCP to create Hybrid Access Networks

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1. INTRODUCTION

Broadband Internet access services are key for our digital economy. Many governments have passed laws that require ISPs to deliver high speed broadband services to *all* citizens before a given date. In Europe, the objective is to reach 30 Mbps before 2020 *everywhere*. Other countries have similar objectives[5]. One option for network operators would be to deploy fiber everywhere, but this is very costly. A recent report from the Fiber-To-The-Home (FTTH) Council in Europe estimates[1] a cost of 137 billion Euros to install fibers through all houses in Europe and connect 50% of them to the network. In many countries, it is difficult to deploy high-speed broadband services in rural areas in a cost effective manner [5]. To meet their government's objectives, many operators explore the possibility of combining different access networks together to bring higher bandwidth services to their customers. A very popular use case is to combine xDSL with LTE to create Hybrid Access Networks. The BroadBand Forum has specified an architecture [3] for such hybrid networks.

2. MULTIPATH BECOMES THE NORM

A naive approach to combine xDSL and LTE networks would be to use per-packet or per-flow load-balancing on the access router. Unfortunately, per-packet load-balancing is not suitable for TCP connections because packets from a single connection observe different delays and packet losses and TCP's congestion control scheme cannot easily handle such changing conditions. Per-flow load-balancing is a better match for TCP, but a single connection cannot use more bandwidth that the link (xDSL or LTE) it currently uses. This limits the bandwidth that end users can really use.

Multipath TCP [4] is a TCP extension that enables end-hosts to exchange the data belonging to a single connection over multiple paths. Multipath TCP maintains state about the paths that it uses and can detect that one path is currently more congested than the other. Unfortunately, Multipath TCP is not yet widely deployed for popular web applications. Tessares' hybrid access network solution is a set of Multipath TCP to TCP proxies that are installed on the xDSL or LTE access router and the datacenters of the network operator. The design of these proxies was initially presented in [2]. It has been refined to cope with operational constraints [6] and the IETF is progressing towards a standardised approach [1].

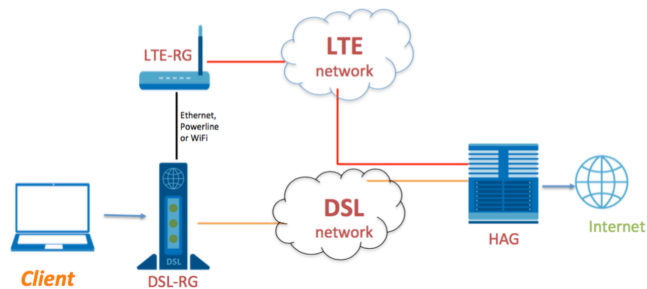During this demonstration, we will show a typical de-

Figure 1: Tessares' demo setup

ployment of Tessares' hybrid access network solution on the setup shown in figure 1. The DSL-router is configured to redirect all packets towards the LTE gateway that includes Tessares' Multipath TCP software. The LTE gateway intercepts all TCP connections established by the client and converts them into Multipath TCP connections that use both the xDSL (simulated with an Ethernet uplink) and the LTE network. Those Multipath TCP connections are converted back to regular TCP connections through a Hybrid Access Gateway (HAG) hosted in a datacenter. We demonstrate how the Tessares solution enables network operators to improve customer experience by increasing bandwidth and reducing page load times while minimising the usage of the LTE network with Tessares' path manager.

3. REFERENCES

[1] O. Bonaventure et al. 0-RTT TCP converters. Internet draft, draft-bonaventure-mptcp-converters-01, July 2017.

[2] G. Detal et al. Multipath in the middle(box). In *HotMiddlebox '13*, pages 1–6, 2013.

[3] G. Fabregas (Ed). TR-348 Hybrid Access Broadband Network Architecture. July 2016.

[4] A. Ford et al. TCP Extensions for Multipath Operation with Multiple Addresses. RFC 6824, January 2013.

[5] S. Meyers. Australia's leadership in providing rural broadband. http://bit.ly/2qkIEnq, May 2017.

[6] B. Peirens et al. Link bonding with transparent Multipath TCP. Internet draft, draft-peirens-mptcp-transparent-00, July 2016.

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[1]See http://bit.ly/2p5DoTp