

Chapter 36

Big Data in Telecommunications: Seamless Network Discovery and Traffic Steering with Crowd Intelligence

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ABSTRACT

The meteoric rise of smart devices in dominating worldwide consumer electronics market complemented with data-hungry mobile applications and widely accessible heterogeneous networks e.g. 3G, 4G LTE and Wi-Fi, have elevated Mobile Internet from a ‘nice-to-have’ to a mandatory feature on every mobile computing device. This has spurred serious data traffic congestion on mobile networks as a consequence. The nature of mobile network traffic today is more like little Data Tsunami, unpredictable in terms of time and location while pounding the access networks with waves of data streams. This chapter explains how Big Data analytics can be applied to understand the Device-Network-Application (DNA) dimensions in annotating mobile connectivity routine and how Simplify, a seamless network discovery solution developed at Nextwave Technology, can be extended to leverage crowd intelligence in predicting and collaboratively shaping mobile data traffic towards achieving real-time network congestion control. The chapter also presents the Big Data architecture hosted on Google Cloud Platform powering the backbone behind Simplify in realizing its intelligent traffic steering solution.

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INTRODUCTION

On a cold Spring day in March 2011, Japan was struck by a deadly tsunami following a strong earthquake. The aftermath was devastating, not only destruction was brought into its physical terrain, the Internet has also suffered huge ‘*data tsunami*’ where millions of online readers roamed into major news websites, following every emergency update. With smart communication devices dominating the global consumer electronics market, posting high-resolution pictures and streaming high-definition videos over wireless networks are becoming the norms for smartphone users (Tay, 2012). Complemented with more affordable mobile broadband packages and widely accessible high-speed data networks, wireless networks today are constantly plagued by daily ‘*data tsunamis*’.

In suppressing mobile network congestion, mobile operators often impose data limits and fair usage policies at a costly trade-off. Not only did data capping and network throttling significantly impede user experience, implementing such mechanisms incur heavy monitoring costs on the mobile operators. While understanding network traffic trend is far beyond any straightforward mathematical equation, the sporadic nature of mobile connectivity makes network congestion complex, unpredictable and difficult to eradicate. At such, traditional radio network planning and progressive network capacity upgrades may no longer be sufficient to serve the fluctuating connectivity demand. This poses serious threats to mobile operators in need for a more effective solution for real-time congestion control.

In this chapter, we will examine *Simplify*, a mobile data solution developed at Nextwave Technology aiming to solve network congestion woes by applying Big Data technologies in forecasting, shaping and routing mobile network traffic based on analysis of real-time data collected from mobile devices. By analysing human mobility patterns and understanding their connectivity routines, *Simplify* is able to predict network behaviours and prescribe personalized network policies to each mobile device in realizing dynamic network traffic steering while improving Mobile Internet experience.

BACKGROUND

In the effort to curb mobile network congestion, the challenges facing mobile operators are far more complex than just scaling up their network infrastructure. As fluctuating mobile data demand varies from area to area, on-demand network capacity allocation is almost a mandatory requirement. Despite the advancements in software-defined radio network technologies, which allow mobile operators to flexibly configure network capacity on the fly, such deployment requires costly upgrade to existing radio base stations. Instead, the immediate priority should focus on optimizing existing mobile network traffic by reducing the cost per megabyte while maintaining good user experience.

One immediate remedy to ease mobile congestion is to employ Wi-Fi offloading solution, diverting mobile data traffic towards Wi-Fi networks. Cisco (2014) has reported that approximately 45 percent of global mobile data traffic (1.2 Exabytes per month) was offloaded onto the fixed network through Wi-Fi and Femtocell in 2013. This figure is expected to reach 51 percent (17.3 Exabytes per month) by 2018. In this section, as a prelude to our work on *Simplify*, we will first focus our evaluation on contemporary Wi-Fi offloading solutions and other related work in relieving mobile network congestion.

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