An Intelligent Data Visualization Service Platform for Mobile Network Operators

Naz Albayrak and Engin Zeydan

Türk Telekom Labs, Istanbul, Turkey. Email: {naz.albayrak, engin.zeydan}@turktelekom.com.tr

***Abstract*—In this demo, we are proposing an intelligent heatmap service that can be utilized by Mobile Network Operators (MNOs). The demo platform consists of big data enabled ecosystem that can perform analytics over MNO's data which can be serviced to third parties as location based service. As a use case scenario, we are investigating how does the density of mobile subscriber change during the day of the week in Istanbul's historic peninsula. Our results interestingly indicate that based on the heatmap densities built by number of signals received from mobile subscribers, weekdays can be more crowded than weekends in historical touristic locations of Istanbul.**

***Index Terms*—MNOs, heatmaps, location, service.**

I. Introduction

As a technology solution, big data analytics can provide great advantage for target audience analysis and marketing campaigns at appropriate time and space. Hence, big data makes it possible to use the richer and/or previously not-included data inside corporate life [1]. In this demo study, we are investigating the behaviour of telecom customers during weekend and weekdays using a heatmap analysis. The pilot city is chosen as Istanbul city in Turkey. OpenStreetMap [2], an open source map application, was used to generate map data (geographical data related to Istanbul for this work) that should be placed based on the platform developed within the scope of the considered scenario. Mobile subscriber density maps visualize subscriber densities using a predetermined color scale. From density map applications, it is possible to obtain subscriber density map images at specific frequencies by taking a screen image, specifically for a specific region.

II. A Platform for Intelligent Data Visualization

In this study, the proposed platform takes mobile subscriber density data as a basis for further analysis. The colors on the density map indicate the density of the subscribers. The meanings are as follows: Green indicates that the low density, orange indicates medium intensity and red indicates high intensity. The massive data generated by customers enables the telecom operators to develop enriched 360-degree customer profiles, build customer-focused key performance indicators (KPIs) and develop more targeted proposals with accurate analysis techniques. In this work, the following customer data components of the telecom operators are used in order to obtain meaningful customer insights: (i) *Customer Information:* Customer identity, demographic, services used, spending patterns, usage plan, line type, customer type (Premium, young tariff) etc. (ii) *Device Data:* Brand, model, series, applications, technology used, device history. (iii) *Usage Data:* Call Detail Record (CDR), Extended Data Record (XDR), average income. (iv) *Location:* Current location, most visited location, signal frequency, home / work / holiday locations etc.

Some of the definitions of the utilized components shown in Fig. 1 are as follows: **XDR:** A data set is produced within the core network. There are also records such as failed records and handover records that are not in the CDR. Basically, PS and CS are divided into two parts: The PS defines the data set for the use of mobile data (mobile internet) whereas CS defines the data set of basic communication activities such as call, SMS and ho (handover). Only CS data is taken and processed in this demo environment. In our environment, the data that comes with Flume is processed and written into Hadoop Distributed File System (HDFS). Data is continuously processed in real time. **CDR:** It is the most basic network record that is produced in core network. There are many types of this dataset and all are taken toData Warehouse (DWH). CDR data is received and processed on a monthly basis. The CDR contains only successful records. With this data set, data for cellular networks are collected. **CDR ETL:** This application is a java application that is developed and written to HDFS by downloading and formatting CDR data. **DWH:** Subscriber and churn data are transferred directly to HDFS using Sqoop and Oracle Data Integrator (ODI).

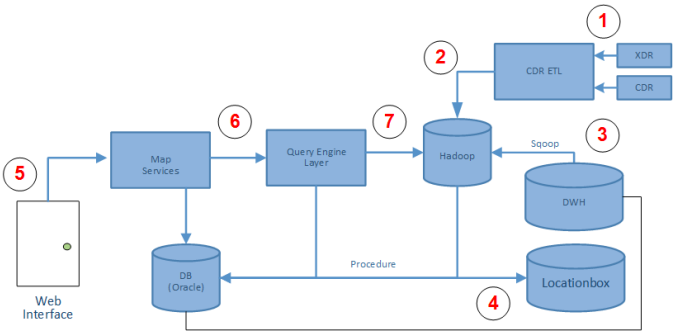
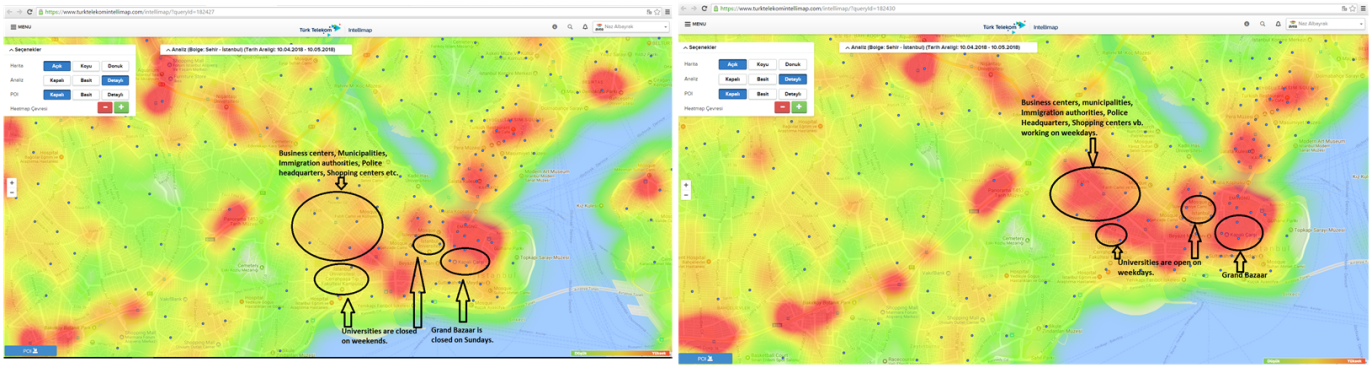


Fig. 1: Demonstration Setup

III. Demonstration

A. Demonstration WorkFlow

During the demo, we demonstrate how density of mobile subscribers is scattered on working days compared to week-



a) b)

Fig. 2: Heatmap of Istanbul Historic Peninsula during (a) weekends and (b) weekday

ends. Densities can be compared using open-source analytic software. The general workflow, which is also demonstrated in Fig. 1, is as follows: First, XDR and CDR data are downloaded and formatted with SFTP and written to Hadoop (HDFS) as illustrated by step-(1). HDFS is used as a file system for storing data in step-(2). In this step, subscriber and churn data are transferred directly to HDFS using Sqoop and ODI from DWH as shown in step-(3). The locationbox tag cell address data is transferred to HDFS and RedisDB as in step-(4). The user can access into the web interface in order to run analysis as in step-(5). Then, analytical filters that are applied via the web interface as in step-(6). Finally, step 7, the queries generated by the filters determined from the interface are transmitted and a density map is created.

B. Analysis of Demonstration Results

Fig. 2 shows the dashboard of Istanbul Historic Peninsula. The density of mobile subscribers rapidly increasing and decreasing all day long. Operator mobile subscribers data used throughout the demonstration. The data set used for the demonstration covers time scale from April 2018 to May 2018. Fig. 2 shows the density of Istanbul Historic Peninsula on weekdays compared to weekends. Based on the densities in these figures, in Istanbul Historic Peninsula, we can observe that weekdays are much more crowded than the weekends. The reason is that there are many business centers, passages, government agencies and universities in this region. However, these regions are closed on Sundays. Additionally, the most touristic “Grand Bazaar” is also closed on Sundays.

REFERENCES

[1] E. Zeydan, E. Bastug, M. Bennis, M. A. Kader, I. A. Karatepe, A. S. Er, and M. Debbah, “Big data caching for networking: Moving from cloud to edge,” *IEEE Communications Magazine*, vol. 54, no. 9, pp. 36–42, 2016.

[2] M. Haklay and P. Weber, “Openstreetmap: User-generated street maps,” *IEEE Pervasive Computing*, vol. 7, no. 4, pp. 12–18, 2008.